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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/080,119	02/21/2002	Don Carl Powell	MIO 0060 VA-98-0814.01	9570

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EXAMINER

LE, DUNG ANH

ART UNIT	PAPER NUMBER
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2818

DATE MAILED: 07/11/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/080,119

Applicant(s)

POWELL ET AL

Examiner

DUNG A LE

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 16 April 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1 and 3-32 is/are pending in the application.
- 4a) Of the above claim(s) 13-25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-12 and 26-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other

DETAILED ACTION

This is a new ground of rejection. Previous office action has been withdrawn.

Claim Rejections

Set of Claims: 1-8.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 4 - 8 are rejected under 35 USC 102 (e) as being anticipated by Huang et al. (6291288) and in view of Yau et al. (6245690).

Regarding claim 1, Huang et al. disclose a method of forming a dielectric layer on a semiconductor device comprising:

providing a substrate having at least one semiconductor layer;

forming a first conductive layer 100 over at least a portion of the substrate (col 3, lines 26-33);

depositing a silicon-containing material from a silicon source (polysilicon) on the first conductive layer 100 (col 3, 30-33) (Note: it is inherent that exposing polysilicon to

the air in depositing chamber causes the silicon-containing material which is deposited on contact to the surface of the conductive layer 100) ;

forming the dielectric layer (oxide layer 110) by processing the deposited silicon-containing material (polysilicon) with a reactive agent selected to react with silicon atoms of the deposited silicon-containing material (col 3, 30-33).

Huang et al. do not teach a silicon source comprising silazane.

Yau et al. teach a silicon source comprising silazane (col 3, lines 15- 30).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize silazane as the deposited material for forming a dielectric layer, as taught by Yau et al. in order to provide low dielectric constant and good moisture barrier properties for use in integrated circuits (col 3, lines 10).

Regarding claim 2, (canceled).

Regarding claims 5- 8, Huang and Yau do not teach the reactive agent is selected from the group comprising NH_3 , N_2O_2 , O_3 , N_2O and NO ; the silicon source comprises a self limiting hexamethyldisilazane source and the dielectric layer is primarily nitride/oxide.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form the reactive agent is selected from the group comprising NH_3 , N_2O_2 , O_3 , N_2O and NO ; utilize the silicon source comprises a self limiting hexamethyldisilazane source and the dielectric layer is primarily nitride/oxide because

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the abovementioned material are commonly used to prevent undesirable reactions in the contact region, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use.

Regarding claim 8, Huang and Yau fail to teach the dielectric having the thickness is about 45A or less as recited in present claim 8.

It would have been obvious to one of ordinary skill in the art of making semiconductor devices to determine the dielectric having the thickness is about 45A or less as the workable or optimal ranges for the aforementioned thickness through routine experimentation and optimization to obtain optimal device performance.

Claim 3.

Huang et al. disclose a method of forming a dielectric layer on a semiconductor device comprising:

providing a substrate having at least one semiconductor layer;
forming a first conductive layer 100 over at least a portion of the substrate (col 3, lines 26-33);
depositing a silicon-containing material from a silicon source (polysilicon) from the group consisting of hexamethyldisilazane, tetramethyldisilazane, octamethylcyclotetrasilazine, hexamethylcyclotrisilazine, diethylaminotrimethylsilane and dimethylaminotrimethylsilane

Huang et al. do not teach a silicon source comprising silazane.

Yau et al. teach a silicon source comprising hexamethyldisilazane (col 3, lines 15-30).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize hexamethyldisilazane as the deposited material for forming a dielectric layer, as taught by Yau et al. in order to provide low dielectric constant and good moisture barrier properties for use in integrated circuits. (col 3, lines 10).

Set of claims: 9-11.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 9-11 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Huang et al. (6291288) in view of Yau et al. (6245690).

Huang et al. disclose a method of forming a dielectric layer on a semiconductor device comprising:

providing a substrate having at least one semiconductor layer; fabricating the semiconductor device proximate to the substrate (col 3, lines 27-33 and fig. 1) (Note: it is inherent that exposing polysilicon (a silicon-containing material) to the air in depositing chamber causes the silicon-containing material which is deposited on contact to the surface of the substrate);

vapor depositing a silicon-containing material over at least a portion of the semiconductor device; and

forming the dielectric layer 110 by processing the silicon-containing material in a reactive ambient.

Huang et al. do not disclose a silicon-containing material from a silazane source.

Yau et al. teach a silicon source comprising silazane (col 3, lines 15- 30).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize silazane as the deposited material for forming a dielectric

layer, as taught by Yau et al. in order to provide low dielectric constant and good moisture barrier properties for use in integrated circuits (col 3, lines 10).

Regarding claims 10 and 11, vapor depositing a silicon-containing material from a silazane source over at least a portion of the semiconductor device is repeated at least once prior to forming the dielectric layer by processing the silicon-containing material in a reactive ambient (col 3, lines 15- 30)

Claim 12.

Claim 12 is rejected under 35 USC 102 (e) as being anticipated by Huang et al. (6291288).

Huang et al. disclose a method of forming a dielectric layer comprising:
providing a substrate having at least one semiconductor layer (col 3, lines 27-33 and fig. 1);

vapor depositing a silicon-containing material (col 4, line 4-10) from a self limiting silicon source (polysilicon), see column 3, lines 30- 33 over at least a portion of the substrate 100; and

forming the dielectric layer (oxide layer 110) by processing the silicon-containing material in a reactive ambient at a processing temperature, a processing time and a processing pressure selected to result in a desired dielectric constant and leakage characteristics (Note: It is inherent that in order to form the dielectric layer the above

parameters such as a processing temperature, a processing time and a processing pressure are needed)

Set of claims: 26- 30

Claims 26- 30 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Huang et al. (6291288) in view of Yau et al. (6245690).

Huang et al. teach a method of forming a dielectric layer comprising:
providing a substrate having at least one semiconductor layer; depositing a silicon-containing material (polysilicon) from a silicon source on at least a portion of the substrate (Note: it is inherent that exposing polysilicon to the air in depositing chamber causes the silicon-containing material which is deposited on contact to the surface of the conductive layer 100); and forming the dielectric layer 110 by processing the silicon-containing material in a reactive ambient.

Huang et al. do not disclose a silicon-containing material from a silazane source.

Yau et al. teach a silicon source comprising silazane (col 3, lines 15- 30).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize silazane as the deposited material for forming a dielectric layer, as taught by Yau et al. in order to provide low dielectric constant and good moisture barrier properties for use in integrated circuits (col 3, lines 10).

Set of claims: 31-32.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 31-32 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Chew et al. (6258653) in view of Nishio et al. (5567661).

Chew et al. disclose a method of forming a dielectric layer comprising:

providing a substrate having at least one semiconductor layer 12;

vapor depositing a silicon-containing material (col 3, lines 55-63) over at least a portion of the substrate

forming a dielectric layer 14 by rapidly thermally nitridizing the deposited silicon containing material in a nitridizing agent (col 4, lines 15-30).

Chew et al. do not disclose a silicon-containing material comprising a silazane.

Nishio et al. disclose a silicon-containing material comprising a silazane (col 2, lines 55-60).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to perform vapor depositing a silicon-containing material comprising a silazane over at least a portion of the substrate, as taught by Chew et al. in order to obtain the best dielectric constant and reduce current leakage.

Regarding claim 32, depositing a second dielectric layer 16 over the dielectric layer 14 (fig. 1).

When responding to the office action, Applicants' are advice to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dung A. Le whose telephone number is 703-306-5797. The examiner can normally be reached on Monday-Friday 8:00am-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on 703-308-4910. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Dung A. Le
Examiner

